

Claims:

1. Dry shaving apparatus comprising:

a drive source (260) provided in a housing;

5 a first shaving unit (141; 222) coupled to the drive source (260) and having a first outer cutter (7) and a first undercutter (6) mounted for relative movement therebetween; and

10 a second shaving unit (112, 113; 201, 203) having a second outer cutter (1462, 1463; 2251, 2252) and a second undercutter (181; 251) coupled to the drive source (260) and mounted for oscillatory movement beneath said second outer cutter;

characterised in that:

15 the first outer cutter (7) is coupled to the drive source (260) and is mounted for oscillatory movement to serve as a skin agitation member; and

20 the first outer cutter (7) and the second undercutter (181; 251) are arranged to be driven at the same frequency by the drive source.

2. Dry shaving apparatus comprising:

a drive source provided in a housing;

25 a first shaving unit coupled to the drive source and having a first outer cutter and a first undercutter mounted for relative movement therebetween; and at least one further shaving unit having a second outer cutter and a second undercutter coupled to the drive source and mounted for movement beneath said second outer cutter;

30 characterised in that:

at least the outer cutter of the first shaving unit is coupled to the drive source and is mounted for oscillatory movement to agitate the skin under a further of the shaving units.

3. Apparatus according to claim 2 wherein the first outer cutter is coupled to the drive source in a manner to be driven at a frequency which differs from that of said second undercutter.
- 5 4. Apparatus according to claim 3 wherein the frequency ratio between that of the second undercutter and of the first outer cutter is in the range 0.5 to 2.
- 10 5. Apparatus according to claim 4 wherein the first outer cutter is arranged to be driven at a lower frequency than said second undercutter.
- 15 6. Apparatus according to claim 1 or 2 wherein the first outer cutter is coupled to the drive source in a manner such that it leads or lags the second undercutter by a phase angle in the range  $0^{\circ}$  to  $135^{\circ}$ .
- 20 7. Apparatus according to claim 6 wherein the phase angle is in the range  $0^{\circ}$  to  $90^{\circ}$ .
8. Apparatus according to claim 7 wherein the phase angle is substantially  $0^{\circ}$  for short hairs.
- 25 9. Apparatus according to claim 7 wherein the phase angle is substantially  $90^{\circ}$  lagging for long hairs.
- 30 10. Apparatus according to any preceding claim further comprising a third shaving unit (113; 203), having a third outer cutter (1463; 2252) and a third undercutter (181; 251) coupled to the drive source (260) and mounted for oscillatory movement relative to the third outer cutter.
- 35 11. Apparatus according to claim 10 wherein the third undercutter is coupled to the drive source in a manner such

that it is driven in phase or antiphase with the second undercutter.

12. Apparatus according to claim 10 or 11 wherein said first shaving unit is provided between the second and third shaving units, and each of the second and third outer cutters is inactive.

13. Apparatus according to any preceding claim wherein all shaving units are positioned in such a manner that the skin-engaging surfaces of said shaving units are coplanar.

14. Apparatus according to any one of the preceding claims wherein more than half of all cutting elements provided are coupled to the drive source.

15. Apparatus according to any preceding claim wherein the second undercutter is coupled to be driven in phase with the first undercutter.

16. Apparatus according to any preceding claim wherein the first undercutter (6) is coupled to the first outer cutter (7).

17. Apparatus according to claim 16 wherein the first outer cutter is coupled with its cooperating undercutter by means of a linkage (11, 12; 42, 44, 41; 338).

18. Apparatus according to claim 17 wherein said linkage comprises a bell-crank (356) and an arm member for movement of the outer cutter.

19. Apparatus according to claim 18 wherein the first outer cutter is mounted on first and second movable carriers

(331,322) each of which is pivotably connected to a chassis of the first shaving unit.

20. Apparatus according to claim 19 wherein said arm member  
5 is a double arm lever (352) and wherein said first movable carrier (331) is connected to the double arm lever (352) via a first film hinge device (351), said double arm lever (352) is connected to the bell crank (356) via a second film hinge device (353,354) and said bell crank is connected to a carrier  
10 (333) for the undercutter via a third film hinge device (357,359).

21. Apparatus according to claim 20 wherein said second and third film hinge devices include at least one stabilizer  
15 (354,358).

22. Apparatus according to any preceding claim wherein the first outer cutter (7) is decoupled from the first undercutter.  
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23. Apparatus according to any preceding claim wherein the first shaving unit is constructed as a long hair cutter or a trimmer.

24. Apparatus according to any one of claims 1 to 23 wherein the first outer cutter is mounted for linear reciprocation.  
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25. Apparatus according to any one of claims 1 to 23 wherein the first outer cutter is mounted for rotary reciprocation.  
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26. Apparatus according to any preceding claim wherein the first outer cutter has an outer surface adapted for enhanced grip on the skin.

27. Apparatus according to any preceding claim wherein the second outer cutter is inactive.

28. Apparatus according to any preceding claim wherein the  
5 second outer cutter has a low friction outer surface.

29. Apparatus according to any preceding claim wherein  
at least one undercutter is mounted on an undercutter module  
coupled to said drive source.

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30. Apparatus according to claim 29 wherein said undercutter  
module is guided by at least one guide rod.

31. Apparatus according to claim 30 wherein said guide rod is  
15 mounted on a chassis module (145).

32. Apparatus according to claim 31 wherein at least one  
shaving unit is secured to a frame (146) movably mounted in  
said chassis module.

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33. Apparatus according to claim 32 wherein said at least one  
shaving unit is mounted floatably for up and down movement in  
said chassis module.

25 34. Apparatus according to claim 33 wherein said floating  
shaving unit comprises an inactive outer cutter.

35. Apparatus according to claim 33 wherein said floating  
shaving unit comprises an active outer cutter.

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36. Apparatus according to any one of claims 31 to 35 wherein  
said chassis module (145) is mounted on the housing of the dry  
shaving apparatus.

37. Apparatus according to claim 36 wherein said chassis module is movably mounted on said housing.

38. Apparatus according to any one of claims 31 to 37 wherein  
5 a frame assembly (146) is removably mountable on said chassis module.

39. Apparatus according to claim 38 wherein at least one  
10 outer cutter of one shaving unit is statically mounted in said frame.

40. Apparatus according to claim 39 wherein the undercutter of said one shaving unit is mounted on said chassis module.

15 41. Apparatus according to any preceding claim wherein a gearbox is provided to couple the drive source to each shaving unit.

42. Apparatus according to claim 41 further comprising:  
20 a first drive shaft coupled to the drive source; the first drive shaft carrying a first gear means and a first eccentric camming element; a second drive shaft carrying a second gear means and a second eccentric camming element; the second gear means being in mesh with the first gear means; and  
25 the first and second camming elements being arranged to engage first and second follower means coupled to respective shaving units.

43. Apparatus according to claim 42 further comprising a  
30 third drive shaft carrying a third gear means and a third eccentric camming element, the third gear means being in mesh with one of the first and second gear means, and the third camming element engaging a third follower means coupled to one of the shaving units.

44. Apparatus according to claim 43 when dependent on claim 10 wherein the third follower means is coupled to the third shaving unit.

5 45. A dry shaver cartridge comprising an outer cutter and a movable undercutter both mounted for oscillatory motion and a linkage coupling the outer cutter to the undercutter to constrain the outer cutter to move in antiphase with the undercutter.

10 46. A method of shaving in which the skin is agitated at one location in an oscillatory manner and is caused to move at an adjacent location where it is shaved by a moving cutter.

15 47. A method according to claim 46 in which the cutter oscillates with a phase which differs from that of the skin agitation by an angle in the range  $-120^{\circ}$  to  $120^{\circ}$ .

20 48. Any novel feature or combination of features hereinbefore described or illustrated in the drawings.